

What is claimed is:

1. A method of labeling a sample, comprising:
conveying the sample through a channel having a first virtual wall fluid interface
5 port;
separating the sample in the channel into a plurality of bands; and
injecting a labeling solution through the first virtual wall fluid interface port,
wherein the labeling solution interacts with one of said bands to form a labeled band.
- 10 2. The method of claim 1, further comprising the step of detecting the labeled band.
3. The method of claim 1, further comprising the step of ejecting at least a portion
of the labeled band from the channel.
- 15 4. The method of claim 3, wherein the step of ejecting a portion of the labeled band
comprises ejecting at least a portion of the labeled band through a second virtual wall
interface port in the form of one or more droplets.
5. The method of claim 1, wherein the labeling solution comprises a labeled species
20 and a binding molecule for binding to a selected band and the labeled species.
6. The method of claim 5, wherein the step of injecting the labeling solution
comprises injecting the labeled species through the first virtual wall fluid interface port
and injecting the binding molecule through a second virtual wall fluid interface port.
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7. The method of claim 1, wherein the virtual wall fluid interface port has a
diameter between about 25 μm and about 100 μm , such that when a fluid is disposed in
the interior of the channel, the fluid forms a virtual wall at the virtual wall fluid interface
port.
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8. The method of claim 1, further comprising the step of separating the plurality of
bands in to a plurality of sub-bands.

9. The method of claim 1, further comprising the step of transferring a labeled band to one of a MALDI-MS system and a multi-well plate for further analysis.
10. A method of labeling a sample, comprising:
5 conveying the sample through a channel having a virtual wall fluid interface port; and
injecting a labeling solution through the virtual wall fluid interface port, wherein the labeling solution interacts with the sample to label the sample.
- 10 11. The method of claim 11, further comprising the step of separating the sample into a plurality of bands.
12. A system for performing a labeling operation, comprising:
a column for conveying a sample mixture through the system, wherein the
15 column comprises an interior bounded by a side wall;
a separation region for separating the sample mixture into a plurality of bands;
a first fluid interface port downstream of the separation region for injecting labeling molecules into the interior of the column.
- 20 13. The system of claim 12, further comprising a detector downstream of the first fluid interface port for identifying bands of the sample mixture in the column.
14. The system of claim 12, further comprising a second fluid interface port downstream of the first fluid interface port for injecting a binding molecule into the
25 column.
15. The system of claim 12, further comprising an ejector for ejecting a band of the sample mixture from the column.
- 30 16. The system of claim 12, wherein the ejector comprises a pressure pulse generator, said pressure pulse generator comprising a conical-shaped pressure chamber disposed opposite a second fluid interface port and in communication with the interior of the column and a piezo-actuated membrane connected to the pressure chamber.

17. The system of claim 12, wherein the ejector comprises a pin assembly comprising a first pin and a second pin spaced from the first pin to define a capillary for receiving a liquid volume.

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18. The system of claim 12, further comprising a second fluid interface port formed in the side wall of the column upstream of the separation region for injecting the sample mixture into the column.

10 19. The system of claim 12, wherein the fluid interface port has a diameter between about 25 μm and about 100 μm , such that when a fluid is disposed in the interior of the microchannel, the fluid forms a virtual wall at the fluid interface port.

20. The system of claim 12, further comprising:

15 a second fluid interface port upstream of the separation region for injecting the sample mixture into the column;

a third fluid interface port downstream of the second fluid interface port for injecting a binding molecule into the column, whereby the binding molecule and the labeled molecules interact with a selected band to form a labeled band;

20 a detector downstream of the third fluid interface port for identifying the labeled band; and

an ejector for ejecting the labeled band from the column.